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FACILITATION AND INTERFERENCE IN THE OLDER ADULT LEARNER.
FINAL REPORT.

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THIS STUDY IS CONCERNED WITH THE DEGREE TO WHICH OLDER AND YOUNGER ADULTS ARE SUBJECT TO THE INTERFERING EFFECTS OF PAST HABITS. TO DETERMINE THE EXTENT TO WHICH HYPOTHESES BASED ON ASSUMPTIONS OF CONTEMPORARY INTERFERENCE THEORY HOLD FOR THE OLDER ADULT POPULATION, THESE HYPOTHESES WERE TESTED IN A NEGATIVE TRANSFER TASK, WHERE INCOMPATIBLE RESPONSES IN A SECOND TASK ARE ASSOCIATED WITH IDENTICAL STIMULI FROM AN ORIGINAL TASK. THE RESULTS SHOWED THAT RETENTION CURVES OVER A WEEK WERE COMPARABLE FOR THE YOUNGER AND OLDER AGE GROUPS, ALTHOUGH THE OLDER GROUP TOOK SIGNIFICANTLY LONGER TO LEARN THE TASKS. THIS IMPLIES THAT MEMORY IN THE ADULT IS NOT SO MUCH A FUNCTION OF AGE AS IT IS OF THE DEGREE OF LEARNING, AND ALSO THAT LEARNING IS A FUNCTION OF AGE. THE FINDINGS EXTEND THE GENERALITY OF THE INTERFERENCE THEORY OF FORGETTING TO THE OLDER ADULT POPULATION. A FURTHER IMPLICATION OF THE FINDINGS IS THAT THE FACILITATING MECHANISMS WHICH ARE FOUND TO FACILITATE LEARNING AND RETENTION BY INCREASING RESISTANCE TO INTERFERENCE IN YOUNGER SUBJECTS SHOULD ASLO APPLY TO THE OLDER ADULTS. IT IS SUGGESTED THAT THE ABSENCE OF THESE FACILITATING MECHANISMS MAY BE RESPONSIBLE FOR A LARGE PART OF THE MEMORY LOSS IN ADULTS. (AUTHOR)

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Cincinnati, Ohio

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Summary

The problem under investigation in this study concerns the degree to which older adults, compared to younger adults, are subject to the interfering effects of past habits, especially the interfering effects produced by negative transfer tasks. The objective was to examine the transfer effect of pre-experimental language habits on the ability of the older adult to learn and retain new verbal sequences, as compared to younger adults. To determine the extent to which hypotheses based on assumptions of contemporary interference theory hold for the older adult population, these hypotheses were tested in a negative transfer task, where incompatible responses in a second task are associated with identical stimuli from an original task.

The results showed that retention curves over a week were comparable for the younger and older age groups, although the older group took significantly longer to learn the tasks. This implies that memory in the adult is not so much a function of age as it is of the degree of learning, and also that learning is a function of age. It is recommended that further effort be made to discover principles of content organization and arrangement which facilitate the acquisition of adult learning content.

The finding that memory performance for the older aged subjects is comparable to that of younger college students when retention is measured over one week extends the generality of the interference theory of forgetting. A further implication of this finding is that the facilitating mechanisms, such as encoding, which are found to facilitate learning and retention by increasing resistance to interference in younger subjects should also apply to older adults. It is suggested that the absence of these facilitating mechanisms may be responsible for a large part of the memory loss in adults.

Introduction

The question of whether the older or the younger learner experiences greater interference from past habits is seen by a recent writer on the problems of adult learning (Birren, 1964) as one of the most interesting topics relating to age and learning performance. Interference, here, may be operationally defined as the decline in the probability of a response due to the elicitation of a second, incompatible, response. The specific purpose of the present study was to determine the degree to which older adults are subject to interfering effects produced by negative transfer tasks, where incompatible responses in the second task are associated with the identical or similar stimuli from the first task.

The study of the conditions for learning, which is a primary concern of interference theory research, is also a priority need in adult education research (Kreitlow, 1965). Learning and forgetting are assumed by interference theory to be a function of the conditions of transfer between successive habits. For this reason, as Battig (1966) points out, transfer of training tasks, using verbal learning material, have made up the typical experimental methodology of interference theory research.

Interference theory research has discovered that in negative transfer tasks three processes generally occur: (1) old habits are unlearned during the acquisition of new associations, causing a reduction in the availability of old habits; (2) old, unlearned habits recover spontaneously over time, with the results that there is a shift in the balance of strength in favor of the older habits; and, (3) competition develops between available old and new habits at the time of recall (Postman, 1961).

During learning, subjects obtain an ability to differentiate between two negative transfer tasks. This ability can exist in varying degrees at the time of recall. A high degree of list differentiation averts competition between the task response systems. Interference theory predicts that the degree of list differentiation will be highest immediately after learning the second response system; furthermore, it predicts that this high degree of differentiation will decay as time passes, leading to competition between response systems.

Interference theory predictions and subsequent research findings lead to the conclusion that retention performance is a function of the ability of subjects to (a) recall the response systems, and (b) differentiate task membership of recalled responses over time.

These findings are based on studies using young

college students and are limited in their generalizability to the older adult population. Although it is generally assumed that memory differences do occur between adolescents and adults, no studies are reported in the literature which use older adults as subjects in tests of forgetting under these experimental conditions. Studies using different experimental conditions have been performed in this area (Gladis & Braun, 1958; Korchin & Basowitz, 1957; Ruch, 1934), but these do not provide a basis for comparison with recent interference research findings.

It remains to be established as to what effect an interpolated task has on both immediate and delayed retention of learning material for adults. The purpose of the present research was to measure the ability of older adults to integrate, associate, recall and differentiate responses as compared with college students under twenty-one years of age.

An additional problem considered in this study concerns the transfer effect of pre-experimental language habits on the ability of the older adult to learn and retain new verbal sequences. In stressing the importance of these proactive effects upon storage and recall, Underwood (1957) observes that,

> "A 20-year-old college student will more likely have learned something during his 20 years prior to coming to the laboratory that will interfere with his retention than he will during the 24 hours between the learning and retention test."

Similarly, the 50-year-old adult should experience even stronger interfering effects from pre-experimental habits. To the extent that the prescribed habits to be learned are consistent with pre-existing language habits, positive transfer and facilitation at recall are to be expected; however, if there is competition between the required response sequences and prior language habits there should be negative transfer and interference at recall. Kay (1959) notes that this emphasis upon proactive influences is of considerable significance for aging studies. This question of proactive influences is examined as part of the present study.

The hypotheses of the present study were derived from the interference theory of forgetting. In summary, this theory states that second task (interpolated) learning produces a decline in first task (original) learning. Furthermore, it states that while original learning habits are weak at the end of interpolated learning, task differentiation is strong; however, differentiation decays as the retention interval increases. Over time, the unlearned original learning habits spontaneously recover. When recovery is complete, the competition component then accounts for all

the forgetting of original learning, for, then, competition -- between original and interpolated task responses and from extra-experimental responses -- is the only factor operating. If recovery is not complete, then unlearning is also a factor.

Hypotheses

1. It is hypothesized that the frequency of recalled original learning responses is low at the end of interpolated learning, and over time shows a significant rise followed by decline.

2. It is hypothesized that task (list) differentiation is high at the end of interpolated learning and over time shows a significant decline.

The significance of this investigation is that it provides an indication of the extent to which previous work on interference in forgetting with college-age subjects is applicable to an older adult population. This research will provide a basis for the exploratory study of the effects of contextual cues on the differentiation of verbal and non-verbal habits learned in disparate tasks and the facilitation of recall by older adults.

Methods

Subjects

Two different age groups of male and female subjects were recruited for the study. Subjects were randomly selected from the entire population of the University of North Dakota summer school students falling in the two age groups. There was a total of 144 subjects. The first group of 72 subjects ranged in age from 17 to 19 years. The second group of 72 subjects ranged from 39 to 59 years, with a mean age of 46.4 years.

A prearranged random order schedule was used to assign subjects to conditions. As the subjects appeared at the laboratory they were asked if they would agree to return for a second short session. The time and date of the second session, in which the retention test was given, were withheld until after the learning phase of the first session. Subjects were not told the nature of the second session.

All subjects in the younger group agreed to return on the scheduled date. Two subjects in the older group could not return at the scheduled time and were reassigned from 24-hour and 48-hour to 1-minute and 1-week conditions. After the second session each subject was asked not to discuss the experiment until all subjects had been tested.

Lists

Two lists of eight stimulus-response pairs (Appendix) were used. Each list had three orders. The first order presented for learning was randomly determined. Each order was used first the same number of times. The lists were counterbalanced so that the two lists were used equally as often as the first list learned.

The stimulus terms were nonsense-syllables from Glaze's list (Hilgard, 1951), having association values of 87 to 93 per cent. Intra-stimulus similarity of syllables was low. In these syllables, four vowels were used, each being repeated one time, and there was no duplication of consonants.

The response terms were adjectives from Haagen's tables (1949). The adjectives had low intra-list response similarity and no apparent inter-list response similarity. Frequency ratings for the adjectives used were high on the Thorndike-Lorge word count index, ranging from 46 to A (1 per million). There were no synonyms among the items in a list and no duplications of first letters.

Procedure

The experimental design was a 2 x 4 x 2 factorial with repeated measures on the third factor. The three factors were ages, retention intervals, and lists learned. The experimenter read the learning instructions (Appendix) to the subject. If the subject had any questions, that part of the instructions which was unclear was repeated. After the subject understood the task, he began the experiment by learning one of the lists of eight paired-associates.

The lists were presented on a four-window Lafayette memory drum which presented the stimulus item for 2 seconds followed by the stimulus and response item together for 2 seconds. This procedure was followed for all eight pairs. There was a between-trial interval of 6 seconds, and a 90 second interval separating the learning of the two lists. The first three windows of the drum consecutively presented a different order of a list, through the use of shutters on the windows. For a given subject the orders alternated continuously within lists over all learning trials.

The criterion of list learning was one perfect trial, that is, one trial in which the responses were correctly given to all stimulus terms. One younger subject and four older subjects could not meet this criterion in 30 trials and were no longer used in the study. In each case they were replaced by the next subject.

Retention Tests

The four retention intervals used were 1 minute, 24 hours, 48 hours, and 1 week. These intervals were measured from the conclusion of the criterion trial on List 2 to the start of the recall test. The modified, modified free recall (MMFR) test (Barnes and Underwood, 1959) was presented in the fourth window of the memory drum. Each nonsense-syllable from the experiment was presented in the window, one at a time, along with two blank spaces to the right of the syllable. The subject was instructed to orally fill in the blanks with the two adjectives previously learned with the given syllable. He was further instructed to give the adjectives in the order they came to mind, that is, in the order in which the responses occurred to him, not necessarily in the order in which they were learned. He had a time limit of 30 seconds in which to recall the two adjectives.

After the recall test, the test of list differentiation was presented in the fourth window of the memory drum, where each adjective from the experiment appeared, one at a time. The subject was instructed to identify the adjective

by saying either "first list" or "second list". He had 12 seconds in which to identify each adjective as to its list membership. The eight nonsense syllables in the recall test and the sixteen adjectives in the differentiation test were randomized and presented in one of three orders. The assignment of orders to subjects was on a random basis, with each group of subjects equally divided as to order.

Results

Trials to Criterion

The mean number of trials taken to learn List 1 and the mean number of trials taken to learn List 2 in each combination of retention interval and age group are shown in Table 1. The top half of this table is made up of data for the younger age groups, while the bottom half contains the data for the older age groups. The combined mean number of trials to criterion on List 1 and List 2, respectively, were 10.61 and 8.29 for the younger age group and 14.50 and 12.40 for the older age group.

The second list was learned faster by both age groups than was the first list. The difference between the first and second lists for the younger group was 2.32 trials to learn. The difference between the first and second lists for the older group was 2.10 trials more to learn the first list.

The analysis of variance of the trials taken to reach the learning criterion of one perfect trial on List 1 and List 2 is given in Table 2. The age main effect is statistically significant, indicating a difference in learning ability due to age in favor of younger subjects. The list main effect is also significant, but there are no significant interaction effects. These results indicate the relative effectiveness of the randomization procedure within age groups.

Recall

The mean and standard deviation of the scores obtained by the groups administered the recall test appear in Table 3. The recall scores were considered as proportions of small numbers of possible responses (eight for any one list), and, thus, were transformed to radians (Walker and Lev, 1953) before the analysis of variance. The analysis of variance of the transformed scores is presented in Table 4.

The overall main effect for age and for retention interval is significant, as is the interaction effect for both of these factors. This significant interaction effect indicates that the pattern of the number of responses recalled by each age group depends upon the length of the retention interval. In other words, the magnitude of the difference between age groups is not the same for the different retention intervals.

The analysis of variance reveals a significant difference between lists in the overall mean number of correct responses recalled. The list by retention interval

Table 1

Mean and Standard Deviation of the Trials Taken to Criterion on Lists 1 and 2 by Age and Retention Interval Groups

		Retention Interval			
		1 Minute	24 Hours	48 Hours	1 Week
			Younger Groups		
List 1					
	Mean	10.72	9.66	11.89	10.17
	S.D.	4.38	4.83	6.96	4.84
List 2					
	Mean	9.22	6.88	9.56	7.50
	S.D.	6.90	2.99	6.82	3.50
			Older Groups		
List 1					
	Mean	14.00	16.83	14.00	13.17
	S.D.	7.36	8.12	8.01	6.81
List 2					
	Mean	12.67	12.89	12.22	11.83
	S.D.	5.62	7.19	6.38	5.95

Table 2

Analysis of Variance of the Total Trials to Criterion

Source	df	Mean Square	F
Between Subjects	143		
Age (A)	1	115.20	20.71**
Intervals (B)	3	21.28	.38
AB	3	58.73	1.05
Error between	136	55.60	
Within Subjects	144		
Lists (C)	1	351.12	16.05**
AC	1	.09	.04
BC	3	12.12	.55
ABC	3	4.92	.22
Error within	136	21.87	

** $p < .01$

Table 3

Mean and Standard Deviation of the Responses Recalled on Lists 1 and 2 by Age and Retention Interval Groups

		Retention Interval			
		1 Minute	24 Hours	48 Hours	1 Week
			Younger Groups		
List 1					
	Mean	3.67	4.61	3.33	3.17
	S.D.	1.38	1.58	1.64	1.95
List 2					
	Mean	6.56	5.38	3.83	2.89
	S.D.	1.42	1.46	1.42	1.97
			Older Groups		
List 1					
	Mean	3.11	3.00	3.33	1.83
	S.D.	1.64	1.71	1.85	1.25
List 2					
	Mean	6.61	4.22	4.33	2.17
	S.D.	.92	1.40	1.24	1.58

Table 4

Analysis of Variance of Radian Transformed Recall Scores

Source	df	Mean Square	F
Between Subjects	143		
Age (A)	1	1.97	9.04**
Intervals (B)	3	6.56	30.06**
AB	3	.75	3.42*
Error between	136	.22	
Within Subjects	144		
Lists (C)	1	8.38	52.55**
AC	1	.35	2.19
BC	3	2.71	16.96**
ABC	3	.00	.01
Error within	136	.16	

* $p < .05$
** $p < .01$

interaction is also significant, indicating that the pattern of the number of responses recalled by different retention groups depends upon the list learned.

Since the study was concerned with the differences in retention between the younger and older age groups, the plotted means for response recall of the two age groups are shown in Figure 1. The younger groups will be examined first.

Younger Groups. A Newman-Keuls test on the differences between List 1 means for the younger groups, given in Table 5, reveals that the only significant difference between any of the means is that between 24 hours and 1 week retention groups.

The differences between list means, in Table 6, are shown to be significant for two pairs of means. The first pair is made up of the 1 minute and the 24 hour means, and the second pair is made up of the 48 hour and the 1 week means.

Inspection of Figure 1 reveals that a high probability of a correct response from List 2 is found in the two shortest retention intervals. This high response probability declines rapidly over a 48 hour period. Furthermore, the total decline in response strength in the first two days is greater than that for the last five days of the seven day retention interval. The recall curve for List 1 begins at a low level immediately after learning List 2, rises over 24 hours, and then declines. Only the decline in recall from 24 hours to 1 week is statistically reliable.

Older Groups. A postmortem (Newman-Keuls) test of differences between all pairs of logically ordered pairs of means for List 1 is given in Table 7. The only differences in the means over the week are between the 1 week and the first three retention interval groups.

In like manner, the 1 week group mean for List 2 is significantly different from each of the first three retention interval means, as shown in Table 8. In addition, statistically reliable differences occur between the means for the 1 minute group and the 24 and 48 hour groups.

In comparison, recall on the second list for both age groups is approximately equal over the week. Both groups start at the same point in terms of the number of responses recalled. Although the older group showed a significant decline over the first day and the last five days and the younger group showed a significant decline in recall over the second day, overall, the decline in performance was approximately the same over the week for the two age groups

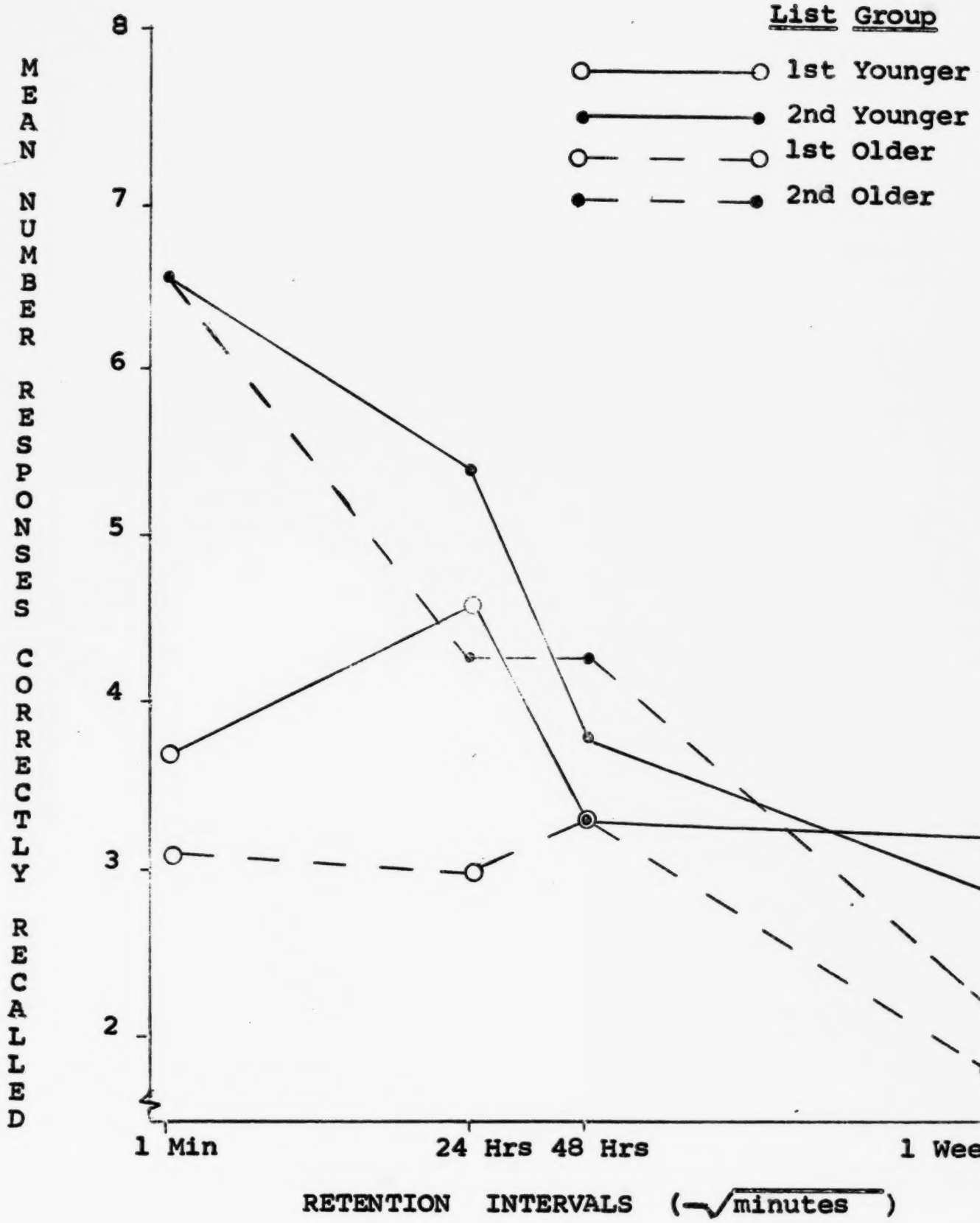

Figure 1. Mean responses correctly recalled on the first and second lists by younger and older groups.

Table 5

Newman-Keuls Analysis of Transformed Means of List 1 Responses Correctly Recalled by the Younger Group

	1 Week	48 Hrs	1 Min	24 Hrs	Shortest Significant Ranges
	1.330	1.394	1.478	1.737	
1 Week		.064	.148	.407*	R_2=.305
48 Hrs			.084	.343	R_3=.364
1 Min				.259	R_4=.399

* $p < .05$

Table 6

Newman-Keuls Analysis of Transformed Means of List 2 Responses Correctly Recalled by the Younger Group

	1 Week	48 Hrs	24 Hrs	1 Min	Shortest Significant Ranges
	1.245	1.522	1.950	2.307	
1 Week		.277	.705**	1.062**	R_2=.305
48 Hrs			.428**	.785**	R_3=.364
24 Hrs				.357	R_4=.399

** $p < .01$

Table 7

Newman-Keuls Analysis of Transformed Means of List 1 Responses Correctly Recalled by the Older Group

	1 Week .960	24 Hrs 1.297	1 Min 1.345	48 Hrs 1.396	Shortest Significant Ranges
1 Week		.337*	.385*	.436*	R_2=.305
24 Hrs			.048	.099	R_3=.364
1 Min				.051	R_4=.399

* $p < .05$

Table 8

Newman-Keuls Analysis of Transformed Means of List 2 Responses Correctly Recalled by the Older Group

	1 Week 1.046	24 Hrs 1.630	48 Hrs 1.656	1 Min 2.310	Shortest Significant Ranges
1 Week		.584**	.610**	1.264**	R_2=.305
24 Hrs			.026	.680**	R_3=.364
48 Hrs				.654**	R_4=.399

** $p < .01$

on second list recall. Recall on the first list differed only by chance immediately after second list learning, for thw two age groups. After 24 hours, the younger group is significantly superior to the older group; however, the recovery for the younger group from one minute to one day is not significant. There is no further significant difference between the two age groups throughout the remaining part of the week.

List Differentiation

Table 9 presents the means and standard deviations of scores obtained by age groups administered the test of list differentiation. This test consisted of 16 adjectives, 8 from each list. The scores in Table 9 represent the total number of list adjectives which subjects correctly identified as to list membership after the recall test. In order to stabilize the variances, the original scores were submitted to a radian transformation. The analysis of variance of the transformed data is given in Table 10. The plot of the test of list differentiation means is shown in Figure 2.

The age factor did not produce a significant difference between the younger and older groups; however, since the purpose of the study was to compare these two groups, the data for the two orders are reported separately.

Younger Groups. Significant overall main effects for the retention interval factor were obtained. Newman-Keuls multiple comparison tests on the transformed means of the retention intervals from the younger groups on Lists 1 and 2 are given in Tables 11 and 12.

These tests show that for both List 1 and List 2 the 1 minute and 24 hour groups differentiated significantly more adjectives than the 1 week group. Also, for each list, the 1 minute group was able to do significantly better than the 48 hour group.

Older Groups. The multiple comparisons tests of means, given in Tables 13 and 14, indicate that the means of the 1 week retention interval groups for Lists 1 and 2 are significantly different from each of the three shorter interval means. In addition, for List 2 the difference between the 48 hour and the 1 minute groups is statistically reliable.

The mean proportions of all recalled adjectives correctly identified as to list, for the four intervals from 1 minute to 1 week, respectively, were .89, .81, .69 and .65 for the younger groups, and .85, .75, .75 and .59 for the older groups of subjects.

Table 9

Mean and Standard Deviation of the Number of Lists 1 and 2 Responses Differentiated by Age and Retention Groups

		Retention Interval			
		1 Minute	24 Hours	48 Hours	1 Week
			Younger Groups		
List 1					
	Mean	7.22	6.56	5.61	5.22
	S.D.	.73	1.10	1.42	1.31
List 2					
	Mean	7.00	6.44	5.44	5.11
	S.D.	1.28	1.10	1.58	1.60
			Older Groups		
List 1					
	Mean	7.33	6.39	6.28	5.22
	S.D.	.77	1.20	.02	1.63
List 2					
	Mean	6.28	5.61	5.67	4.17
	S.D.	1.08	1.58	.77	1.38

Table 10

Analysis of Variance of Radian Transformed List Differentiation Scores

Source	df	Mean Square	F
Between Subjects	143		
Age (A)	1	.33	1.78
Intervals (B)	3	4.88	26.37**
AB	3	.26	1.38
Error between	136	.18	
Within Subjects	144		
Lists (C)	1	1.66	16.43**
AC	1	.99	9.74**
BC	3	.03	.29
ABC	3	.19	.18
Error within	136	.10	

** $p < .01$

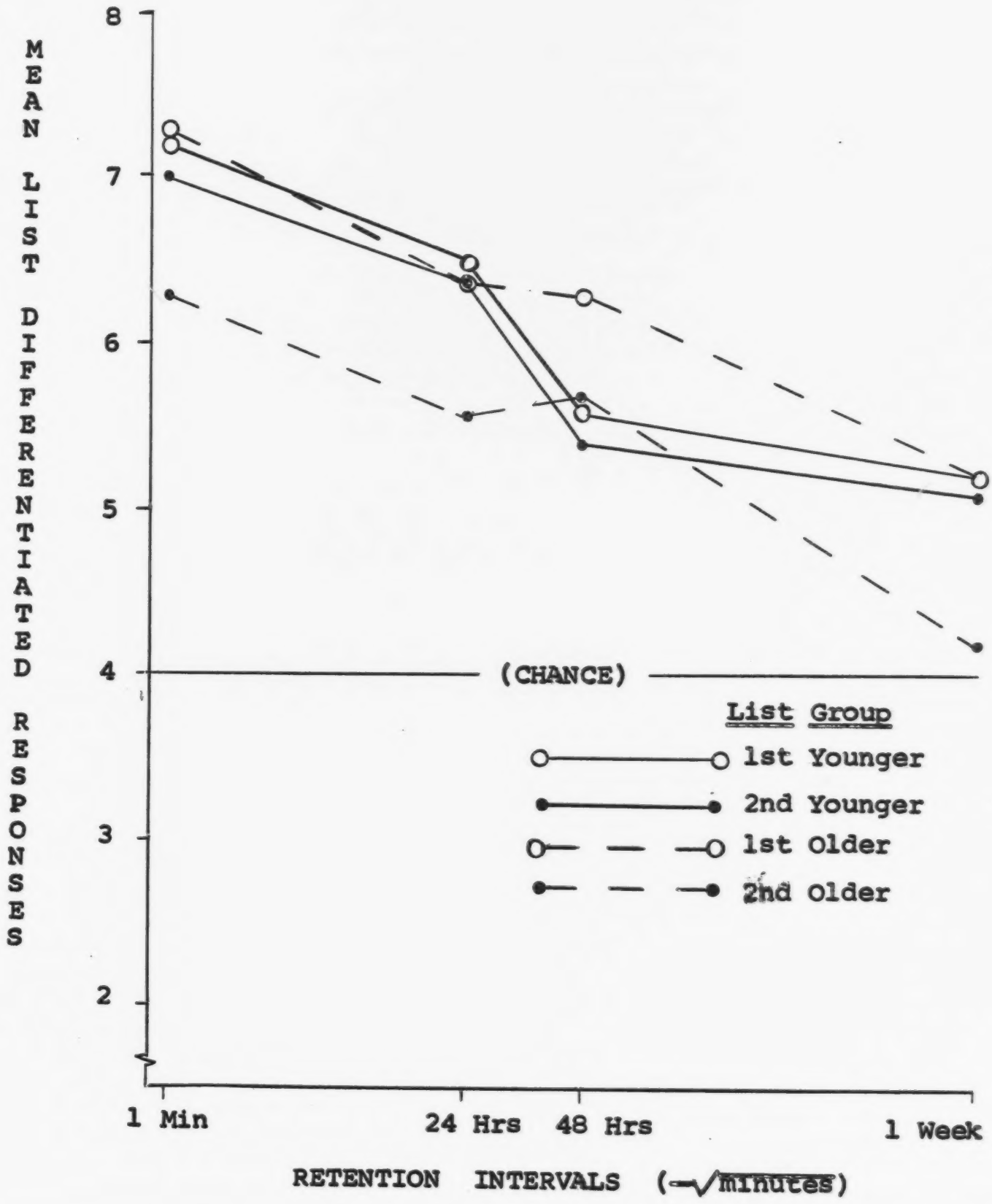

Figure 2. Mean responses correctly differentiated as to list on the first and second lists by younger and older groups of subjects on the list differentiation test.

Table 11

Newman-Keuls Analysis of Transformed Means of List 1 Responses Correctly Differentiated by the Younger Group

	1 Week	48 Hrs	24 Hrs	1 Min	Shortest Significant Ranges
	1.895	2.010	2.302	2.520	
1 Week		.115	.407**	.625**	R_2 = .305
48 Hrs			.292	.510**	R_3 = .364
24 Hrs				.218	R_4 = .399

** $p < .01$

Table 12

Newman-Keuls Analysis of Transformed Means of List 2 Responses Correctly Differentiated by the Younger Group

	1 Week	48 Hrs	24 Hrs	1 Min	Shortest Significant Ranges
	1.878	1.982	2.265	2.463	
1 Week		.104	.387**	.585**	R_2 = .305
48 Hrs			.283	.481**	R_3 = .364
24 Hrs				.198	R_4 = .399

** $p < .01$

Table 13

Newman-Keuls Analysis of Transformed Means of List 1 Responses Correctly Differentiated by the Older Group

	1 Week	48 Hrs	24 Hrs	1 Min	Shortest Significant Ranges
	1.903	2.203	2.253	2.565	
1 Week		.300*	.350*	.662**	R_2 = .305
48 Hrs			.050	.362*	R_3 = .364
24 Hrs				.312	R_4 = .399

* $p < .05$
** $p < .01$

Table 14

Newman-Keuls Analysis of Transformed Means of List 2 Responses Correctly Differentiated by the Older Group

	1 Week	48 Hrs	24 Hrs	1 Min	Shortest Significant Ranges
	1.609	2.007	2.025	2.207	
1 Week		.398**	.416**	.598**	R_2 = .305
48 Hrs			.018	.200	R_3 = .364
24 Hrs				.182	R_4 = .399

** $p < .01$

Conclusions

Over a period of one week the ability of older subjects to recall learned material is approximately the same as the ability of younger subjects to recall identical material. For both the first and the second lists learned, memory performance for older individuals is comparable to that of younger individuals. This conclusion is somewhat surprising in light of the general view of memory ability in the older adult as being inferior to that of the younger adult.

This similarity between the age groups is noted in the recall of both lists of adjectives. Although memory for lists is similar, the older group did take significantly longer in learning each list to the criterion of one errorless trial. This finding leads to the conclusion that memory in the adult is not so much a function of age, within the range sampled, as it is a function of the degree of learning. However, one must conclude from this study that learning ability is a function of age. Thus, in general, the inferior performance of the older population in memory tasks should not be attributed to memory loss until it has first been ascertained that the same criterion of learning has been met by both groups, younger and older.

The results of the older group on the negatively interfering task closely parallels that of the younger group. For both groups, recall for second list responses is high immediately after acquisition, but then shows a constant decline as the retention interval increases. First list responses are poorly recalled after interpolated learning, which is taken as evidence for the unlearning, or extinction, process.

The rise over twenty four hours found in a similar study of younger subjects (McCrystal, 1966), and attributed to spontaneous recovery of first list responses, was not obtained in the present study for either the older or the younger groups. The latter group, however, did evidence superior recall over the older group over the first day. In the period after the first day there appeared to be little difference between the lists, as both declined in strength at approximately the same rate. It may be concluded that the interfering task of learning a second list produced no differential effect between age groups. Furthermore, it may be concluded that competition from a second task, where the stimulus terms are similar to those of the first task but where the response terms are different, will lead to unlearning of the first task responses. The forgetting of the first task is attributed, then, to competition and not to the mere passage of time.

The MMFR recall test used permits both first and

second list responses to be given and, thereby, presumably eliminates competition. Nevertheless, second list recall continued to decline over one week. To what is this decline in recall to be attributed if neither to competition nor to the mere passage of time. Underwood (1957) has shown that proactive inhibition is important in producing such a decline. According to Underwood, this proactive interference arises not so much from the extraexperimental learning that has occurred in the time since learning the laboratory task, but rather from the lifetime of learning which occurred before coming to the laboratory task. Viewed in this manner, it would seem that older subjects should experience much more proactive interference than younger subjects. This is not the case, however, in the present study, where little difference between age groups was detected.

On the list differentiation task the two age groups again showed near equal ability to recognize an adjective as belonging to a particular list. Interference theory holds that as long as task differentiation is good competition between tasks is unlikely, and forgetting should not occur. In the present study the ability to discriminate between list membership did significantly decline for both groups over one week. More information is needed as to how discrimination between tasks learned successively can be increased, since maintaining differentiation should aid retention of learned material.

In experiments of this type, which use a negative transfer paradigm, it is generally found that negative transfer is offset by warm-up and learning to learn, so that second task learning occurs in fewer trials than does original learning. The results of this study for both age groups substantiate the above general finding emphasizing the importance of warm-up and learning to learn.

Since the results from this study show memory performance for older aged individuals to be comparable to that of younger individuals, where the former have taken longer in the acquisition of the learned materials, it is important to determine why older adults do take significantly longer to learn. Slower learning may be due to an inefficiency in short-term memory in the older adult. Another reason for the slower learning may be inferior encoding ability. Interference research has found that encoding is an important process used in learning by young adult learners. Mandler (1967) has noted that one way to get a learner to apply the rules of encoding is to supply him with the appropriate instructions. Without the instructions the rules are come by more slowly and, thus, learning occurs more slowly.

Unfortunately, the area of verbal learning is only beginning to investigate the question of what the learner is

doing when he learns. More research is needed on both the question of content organization and arrangement so as to maximize the transfer value of adult learning content and on the feasibility of teaching rules of encoding which would facilitate the learning of associations by the older adult learner.

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Appendix

Learning Lists

NIT	OPEN	FORMER
SUD	YONDER	TALKING
LIC	AFRAID	WEARY
BOR	HEAVY	PERFECT
KAF	ENTIRE	MERRY
FUZ	SIMPLE	ROYAL
JAS	GLEAMING	DOUBLE
VOL	CRAZY	INJURED

Learning Instructions

This machine will show you a syllable made up of three English letters. After 2 seconds, it will show that syllable followed by an adjective. You are to learn to look at the syllable and call out the adjective before you see it.

The machine will show you 8 pairs, each having a syllable and an adjective. For each pair, you are to learn to look at the syllable and call out the adjective before you see it. The machine will keep showing the pairs until you are able to look at the syllable and call out the adjective before you see it.

Do you have any questions?

Recall Instructions

In this study you learned two lists made up of syllable-adjective pairs. Now, one at a time, you will be shown each syllable followed by two blank spaces. You are to call out the two adjectives which were paired with that syllable. Give the two adjectives in the order in which they come to mind. Do not try to give them in the order you learned them.

Do you have any questions?

List Differentiation Instructions

In this study you learned two lists of adjectives. Now you will be shown each of the adjectives, and you are to call out the list in which the adjective was learned. You should say either "First list" or "Second list".

Do you have any questions?

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800 ABSTRACT This study is concerned with the degree to which older and younger adults are subject to the interfering effects of past habits. To determine the extent to which hypotheses based on assumptions of contemporary interference theory hold for the older adult population, these hypotheses were tested in a negative transfer task, where incompatible responses in a second task are associated with identical stimuli from an original task. The results showed that retention curves over a week were comparable for the younger and older age groups, although the older group took significantly longer to learn the tasks. This implies that memory in the adult is not so much a function of age as it is of the degree of learning, and also that learning is a function of age. The findings extend the generality of the interference theory of forgetting to the older adult population. A further implication of the findings is that the facilitating mechanisms which are found to facilitate learning and retention by increasing resistance to interference in younger subjects should also apply to the older adult. It is suggested that the absence of these facilitating mechanisms may be responsible for a large part of the memory loss in adults.
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